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TITLE: Technologies for Assessing Behavioral and Cognitive Markers of Suicide Risk

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
The primary aim of the proposed project is to develop cognitive and behavioral markers of suicide risk and to evaluate the predictive utility of these markers over a one year period. We propose to achieve these aims by: (a) collecting cognitive and behavioral data from Reserve component soldiers and their romantic partners in both our research laboratory and participant's homes; (b) processing these data using computer algorithms developed specifically for this study; and (c) testing the predictive accuracy of these markers using follow-up data collected from study participants over 12 months. Data collection is still in progress. There are no research findings to report at this this.

15. SUBJECT TERMS
Suicide risk assessment, suicide prevention, signal processing

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON USAMRMC
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**	Unclassified	12	**19b. TELEPHONE NUMBER** *(include area code)*
Unclassified	Unclassified	Unclassified			

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1. INTRODUCTION:

The primary aim of the proposed project is to develop cognitive and behavioral markers of suicide risk and to evaluate the predictive utility of these markers over a one year period. We propose to achieve these aims by: (a) collecting cognitive and behavioral data from Reserve component soldiers and their romantic partners in both our research laboratory and participant's homes; (b) processing these data using computer algorithms developed specifically for this study; and (c) testing the predictive accuracy of these markers using follow-up data collected from study participants over 12 months.

2. KEYWORDS:

Suicide risk assessment, suicide prevention, signal processing

3. ACCOMPLISHMENTS

What were the major goals of the project?

Task 1: Obtain IRB approvals
    1a. Initiate IRB proposal (months 1-3)
    1b. Complete annual reports to IRB (months 12-36)
    1c. Complete final report to IRB (month 36)
Task 2: Hire and train research staff
    2a. Hire and train postdoctoral fellow (months 1-3)
    2b. Train research associates (months 1-3)
Task 3: Begin and complete baseline data collection
    3a. Participant screening & enrollment (months 6-18)
    3b. Begin baseline data collection (month 6)
    3c. Continue baseline data collection (months 6-18)
    3d. Complete baseline data collection (month 18)
Task 4: Begin and complete longitudinal tracking and follow-up assessments
    4a. Begin longitudinal tracking and follow-up assessments (month 6)
    4b. Continue longitudinal tracking and follow-up assessments (months 10-30)
    4c. Complete longitudinal tracking and follow-up assessment (month 30)
Task 5: Use existing data to adapt and refine BSP technologies
    5a. Refine BSP technologies for automatically generating CIRS, SSIRS, & NORS scores (months 3-18)
    5b. Refine BSP technologies for generating feature-derived behavioral markers (months 3-18)
Task 6: Use refined BSP technologies to measure behavioral markers in study data
    6a. Use refined BSP technologies to automatically generate CIRS, SSIRS, & NORS scores (months 18-24)
    6b. Use refined BSP technologies to generate feature-derived behavioral markers (months 18-24)
Task 7: Generate cognitive markers in study data
    7a. Generate cognitive markers in study data (months 18-21)
Task 8: Data analysis, manuscript writing, report writing
    8a. Begin baseline data analyses (month 24)
    8b. Begin data analyses of follow-up data (month 30)
    8c. Manuscript and report writing (months 24-36)
Completion of tasks:
    1a. 100%
    1b. Ongoing
    1c. Not yet started
    2a. 100%

2b. 100%
3a. Ongoing
3b. Ongoing
3c. Ongoing
3d. Not yet started
4a. 100%
4b. Ongoing
4c. Not yet started
5a. 80%
5b. 80%
6a. Not yet started
6b. Not yet started
7a. Not yet started
8a. Not yet started
8b. Not yet started
8c. 25%

What was accomplished under these goals?

Major activities:
1. IRB approval obtained from the University of Utah (initial approval: September 21, 2015; final approval: November 25, 2015), University of Southern California (IRB Authorization Agreement received: September 21, 2015), and HRPO (December 1, 2015).
2. Hired one graduate research assistant, Alexander Crenshaw, for year 2 (September 1, 2017).
3. Continued funding postdoctoral scholar, Feea Leifker, for year 2 (August 8, 2017).
4. Trainings for study staff held February 12, 2016; trainings repeated August 25, 2016 and August 29, 2017 to refresh study staff and to train new study staff.
5. Screening participants initiated February 16, 2016 and is ongoing.
6. Baseline data collection initiated February 26, 2016 and is ongoing.
7. Follow-up data collection initiated on August 8, 2016 and is ongoing.
8. Refinement of existing algorithms for automated coding initiated January 1, 2016 and is ongoing.
9. Refinement of feature-derived behavioral markers initiated March 7, 2016 and is ongoing.
10. Additional, existing data sets transferred to USC to provide additional data for refining automated coding algorithms and feature-derived behavioral markers (April 14, 2016).
11. First project manuscript accepted on March 24, 2017; second project manuscript accepted on September 13, 2017; third project manuscript accepted on September 17, 2017.

Specific objectives:

1. Receive University of Utah, University of Southern California, and HRPO IRB approval.
2. Fully train study staff in study procedures and emergency suicide risk assessment.
3. Begin enrollment of participants.
4. Collect baseline data from 120 couples.
5. Begin follow-up data collection.

Objectives 1, 2, 3, and 5 have been met. Objective 4 has not been met due to unanticipated difficulties with recruitment.

What opportunities for training and professional development has the project provided?

Dr. Baucom, Dr. Bryan, and Alexander Crenshaw, M.S., attended the annual conference of the Association for Behavioral and Cognitive Therapies in New York, NY October 27, 2016 – October 30, 2016.

How were the results disseminated to communities of interest?

Through publication of three manuscripts during the past year of the project.

What do you plan to do during the next reporting period to accomplish the goals?

Our overarching strategy for achieving objective 4 during the next reporting period is to recruit participants with a history of suicidal ideation and/or attempt through more targeted advertisements and direct referrals. We are going to accomplish this plan by (a) conducting chart reviews and reviewing the list of individuals currently and previously at known high risk for suicide at the Salt Lake City Veterans Administration hospital; identified individuals will be directly contacted by study staff to inform them about the study; and, (b) working directly with Reserve Component and Veterans groups leadership in California and Idaho to distribute study information to potential participants; we are collaborating with LTC James McKnight in California and Ms. Melissa Blackwell in Idaho on these efforts.

4. **IMPACT:**

What was the impact on the development of the principal discipline(s) of the project?

Nothing to report.

What was the impact on other disciplines?

Nothing to report.

What was the impact on technology transfer?

Nothing to report

What was the impact on society beyond science and technology?

Nothing to report.

5. **CHANGES/PROBLEMS:**

Changes in approach and reasons for change

Nothing to report.

Actual or anticipated problems or delays and actions or plans to resolve them

Enrollment of study participants continued to be slower than anticipated during year 2. We have taken several steps to increase our rate of enrollment, all of which were first discussed with and approved by Ms. Michelle Lane, the study Scientific Officer, and subsequently approved by the University of Utah and HRPO IRBs as described below. The steps we took include: (a) expanding the inclusion criteria from current members of any Reserve component to including Veterans who had separated from the military in the past 5 years; (b) adding satellite data collection sites in San Diego, CA, Boise,

ID, and St. George, UT; and (c) providing participants the option to conduct the first step of eligibility screening over the internet rather than over the phone.

Changes that had a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Significant changes in use or care of human subjects

As mentioned above, we modified the inclusion and exclusion criteria and added the satellite data collection sites in San Diego, Boise, and St. George. IRB approvals for these changes were received on the dates described below:

- Changes to eligibility criteria and adding satellite data collection sites: U of U IRB approval – 4/11/2017, HRPO approval – 5/30/2017
- Changes to screening methods: U of U IRB approval – 8/9/2017, HRPO requested changes – 9/27/2017; subsequent U of U IRB submission – 10/15/2017 (currently under review)

Approvals for these amendments were not sought from the University of Southern California IRB in addition to those obtained from the University of Utah IRB because the University of Southern California officially agreed to abide by the University of Utah IRB's decision via the IRB Authorization Agreement obtained on September 21, 2015.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use of biohazards and/or select agents

Nothing to report

6. PRODUCTS:

- **Publications, conference papers, and presentations**

  Journal publications.

  Nasir, M., Baucom, B.R.W., Georgiou, P.G., & Narayanan, S.S. (in press). Predicting couple therapy outcomes based on speech acoustic features. PLOS ONE; acknowledgement of federal support (yes)

  Baucom, B.R.W., Leo, K., Adamo, C., Georgiou, P.G., & Baucom, K.J.W. (in press). Conceptual and statistical issues in couples observational research: Rationale and methods for design decisions. Journal of Family Psychology; acknowledgement of federal support (yes)

  Baucom, B.R.W., Georgiou, P.G., Bryan, C.J., Garland, E.L., Leifker, F., May, A., & Narayanan, S.S. (in press). The promise and the challenge of technology-facilitated methods for assessing behavioral and cognitive markers of risk for suicide among U.S. Army National Guard personnel. Journal of Environmental Research and Public Policy, Special Issue: From Understanding Suicide Risk to Preventing Suicide; acknowledgement of federal support (yes)

Books or other non-periodical, one-time publications.

Nothing to report

Other publications, conference papers and presentations.

Li, H., Baucom, B.R.W., & Georgiou, P.G. (2017). Unsupervised latent behavior manifold learning from acoustic features: Audio2Behavior. Interspeech.

Hogan, J.H., Crenshaw, A.O., & Baucom, B.R.W. (2017). Regulatory Over Correction in Romantic Partner's Daily Interactions. Annual meeting of the Association for Behavioral and Cognitive Therapies.

May, A.M., Bryan. C.J., & Baucom, B.R.W. (2017). Communication about suicide history, future suicide risk, and desired interventions within military couples. International Summit on Suicide Research.

Baucom, B.R.W. (2017). Panelist. In K. Bentley (Chair), If I knew then what I know now: Best practices in ambulatory assessment of high-risk populations. Annual meeting of the Association for Behavioral and Cognitive Therapies.

Leo, K., Adamo, C., Georgiou, P.G., Baucom, B.R.W., & Baucom, K.J.W. (2017). Observational coding: Power in the Masses. Annual meeting of the Association for Behavioral and Cognitive Therapies.

Crenshaw, A.O., Leo, K., & Baucom, B.R.W. (May, 2017). Stress impairs empathic accuracy for some, but not others. Association for Psychological Science.

Adamo, C., Leo, K., Hogan, J.N., Crenshaw, A.O., Baucom, K.J.W., & Baucom, B.R.W. (April, 2017). Strong reactions, stronger attributions: Evidence in support of the Polarization Process Model of relationship distress. Annual meeting of the Rocky Mountain Psychological Association.

Leo, K., Crenshaw, A.O., Hogan, J.N., Bourne, S., Chaspari, T., Baucom, K.J.W., & Baucom, B.R.W. (April, 2017). The role of affect modulation in the demand-withdraw interaction pattern. Annual meeting of the Rocky Mountain Psychological Association.

- **Website(s) or other Internet site(s)**

  Nothing to report

- **Technologies or techniques**

  Nothing to report

- **Inventions, patent applications, and/or licenses**

  Nothing to report

- **Other Products**

Nothing to report.

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

What individuals have worked on the project?

Personnel	Role	Percent effort
Baucom, Brian	Principal Investigator	.21
Bryan, Craig	Co-Investigator	.10
Garland, Eric	Co-Investigator	.16
Narayanan, Shrikanth	Co-Investigator	.33
Georgiou, Panayiotis	Co-Principal Investigator	.30
Leifker, Feea	Postdoctoral Research Manager	.166
Crenshaw, Alexander	Graduate Research Assistant	.50
Hogan, Jasara	Graduate Research Assistant	.416
Leo, Karena	Research Manager	.416
Riquino, Michael	Graduate Research Assistant	.50
Priddy, Sarah	Graduate Research Assistant	.50
Skordilis, Zisis	Graduate Research Assistant	.06
Prabakaran, Manojkuma	Graduate Research Assistant	.31
Smith, Caitlin	Graduate Research Assistant	.17
Toutios, Asterios	Graduate Research Assistant	.05
Lim, Yongwan	Graduate Research Assistant	.08
Shivakumar, Prashanth	Graduate Research Assistant	.38
Jati, Arindam	Graduate Research Assistant	.17
Li, Haoqi	Graduate Research Assistant	.38
Md Nasir, Fnu	Graduate Research Assistant	.17
Chakravarthula, Sandeep	Graduate Research Assistant	.38
Park, Tae Jin	Graduate Research Assistant	.06
Tseng, Shao-Yen	Graduate Research Assistant	.26

Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?

Nothing to report.

What other organizations were involved as partners?

Nothing to report.

8. SPECIAL REPORTING REQUIREMENTS

QUAD CHART:

Technologies for assessing behavioral and cognitive markers of suicide risk

PI: Brian Baucom, PhD   **Org:** University of Utah
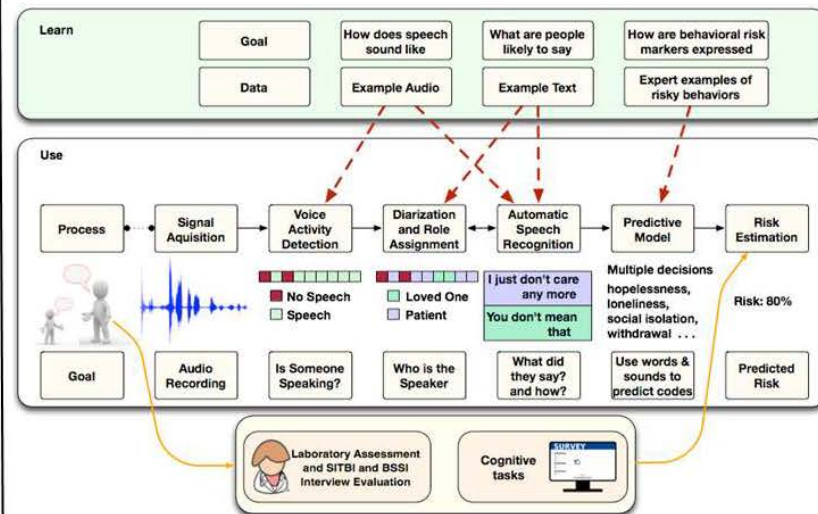
Background

- More than one death by suicide every 13 minutes amongst military personnel
- Accurate and timely assessment of suicide risk one of the most effective ways to prevent injury and death from suicide
- No reliable method for predicting suicide risk in military personnel
- Behavioral (e.g., hopelessness, reassurance seeking) and cognitive (e.g., attentional fixation on suicide-related information) markers could provide new method for objectively assessing risk for suicide
- Recent technology can be adapted for efficient, scalable, and reliable measurement of behavioral and cognitive markers
- Empowers family members by creating a risk assessment tool that can be used at home
- Rich, supplemental, information can be obtained by observing social circle in addition to patient

Approach

- Adapt existing technology for measuring behavioral and cognitive markers of suicide risk using existing data sets
- Observe behaviors of subject, loved ones, family, social circle, and identify behavioral deviations from norm
- Example behaviors of interest: hopelessness, agitation, loneliness, social isolation, engagement and entrainment.
- Collect behavioral, cognitive, interview, and self-report data from 120 couples where at least one partner is active duty National Guardsmen or Reservist in research laboratory
- Create secure internet interface for collecting data at home
- Collect behavioral, cognitive, and self-report data at home after 6 (all forms) and 12 (self-report only) months
- Apply and optimize adapted technology for use in newly collected laboratory and home data
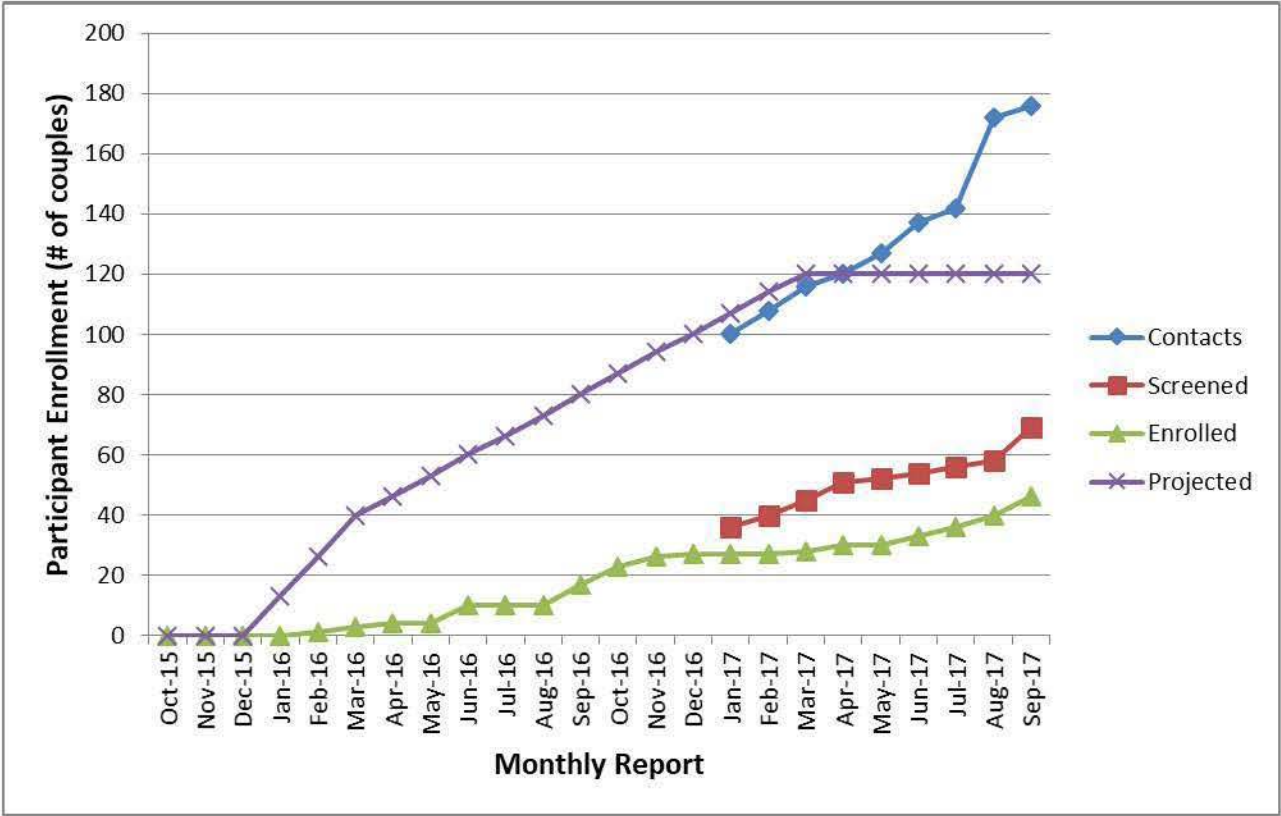
Updated: 10.29.2017

Timeline and Cost

Activities	FY 1	FY 2	FY 3
Train BSP algorithms			
Create secure internet interface			
Collect laboratory- and home-based data from 120 couples			
Apply and refine BSP technologies			
Collect 6 and 12 month follow-up data			
Apply and evaluate adapted technology to newly collected data			
Estimated Budget ($K)	$833	$833	$833

Total expenditure to date: $1,274,206.37

RECRUITMENT GRAPH:

Enrollment table (*N* = 46 couples)

	Index participants with no history of suicidal ideation or attempt	Index participants with a history of suicidal ideation	Index participants with a history of one or more suicidal attempt(s)
Men	23 index (27 counting dual participant couples)	10	1
Women	8	3	3
Reserve Component SMs	35	13	4
Veterans	0	0	0
Army NG	17	9	3
Air Force NG	11	2	1
Army Reserve	4	2	0
Air Force Reserve	3	0	0

Note: Total number of enrolled participants in this table is greater than the number of total enrolled couples due to both partners being in the Reserves in 6 couples.